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Application Number

09/497,320

Filing Date

February 3, 2000

First Named Inventor

Ghaemmaghami et al.

Art Unit

2815

Examiner Name

Jose R. Diaz

Attorney Docket Number

E0545

ENCLOSURES (Check all that apply)

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SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Winstead Sechrest & Minick P.C.		
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Date	November 8, 2004	Reg. No.	47,159

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E0545

PATENT



- 1 -

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Ghaemmaghami et al.

Serial No.: 09/497,320

Filed: February 3, 2000

Group Art Unit: 2815

Before the Examiner: Jose R. Diaz

Title: METHOD AND SYSTEM FOR PROVIDING HALO
IMPLANT TO A SEMICONDUCTOR DEVICE WITH
MINIMAL IMPACT TO THE JUNCTION CAPACITANCE

REQUEST FOR REINSTATEMENT OF APPEAL


Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Office Action (Paper No. 31) having a mailing date of November 1, 2004, reopening prosecution of the above-referenced Application, Applicants respectfully request reinstatement of the Appeal based on the Appeal Brief filed on August 9, 2004 and the Notice of Appeal filed on June 15, 2004.

CERTIFICATION UNDER 37 C.F.R. §1.8

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Signature

Serena Beller

(Printed name of person certifying)

A supplemental appeal brief is filed herewith.

FEE DEFICIENCY

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- ☒ If any additional extension and/or fee is required, this is a request therefor and to charge Account No. 01-0365 (E0545).

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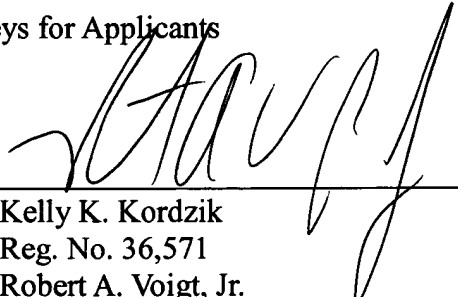
- ☒ If any additional fee for claims is required, charge Account No. 01-0365 (E0545).

Respectfully submitted,

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E0545

PATENT



- 1 -

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Ghaemmaghami et al.

Serial No.: 09/497,320

Filed: February 3, 2000

Group Art Unit: 2815

Before the Examiner: Jose R. Diaz

Title: METHOD AND SYSTEM FOR PROVIDING HALO IMPLANT
TO A SEMICONDUCTOR DEVICE WITH MINIMAL IMPACT
TO THE JUNCTION CAPACITANCE

SUPPLEMENTAL APPEAL BRIEF


Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This supplemental brief is being submitted pursuant to 37 C.F.R. §41.37.

CERTIFICATION UNDER 37 C.F.R. §1.8

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Signature

Serena Beller

(Printed name of person certifying)

I. INCORPORATION BY REFERENCE

Appellants hereby incorporate herein by reference Sections I-VI and VIII-IX of Appellants' Brief mailed on August 9, 2004.

II. NEW GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 18 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Liang et al. (U.S. Patent No. 6,051,458) in view of Wolf et al. ("Silicon Processing for the VLSI Era, Volume 1-Process Technology", pp. 321-324) (hereinafter "Wolf"). Claim 19 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Liang in view of Wolf and in further view of Thompson et al. (U.S. Patent No. 6,020,244) (hereinafter "Thompson"). Claim 20 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Liang in view of Wolf and in further view of Thackeray et al. (U.S. Patent No. 6,037,107) (hereinafter "Thackeray").

III. ADDITIONAL ARGUMENT

A. Claim 18 is not properly rejected under 35 U.S.C. §103(a) as being unpatentable over Liang in view of Wolf.

The Examiner has rejected claim 18 under 35 U.S.C. §103(a) as being unpatentable over Liang in view of Wolf. Paper No. 31, page 5. Appellants respectfully traverse for at least the reasons stated below.

1. By modifying Liang to have a photoresist layer with a thickness between .1 μm and .2 μm , the principle of operation of Liang would change.

The Examiner admits that Liang does not teach a photoresist layer with a thickness between .1 μm and .2 μm , which is a limitation required in claim 18. Paper No. 31, page 5. The Examiner then cites Wolf as support for modifying Liang to have a photoresist layer with a thickness between .1 μm and .2 μm in order to restrict the ionic species from being implanted into unwanted substrate regions. Paper No. 31, page 6. If the proposed modification would render the prior art invention being

modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984). For the reasons discussed below, Appellants submit that by modifying Liang to have a photoresist layer with a thickness between .1 μm and .2 μm , the principle of operation in Liang would change and subsequently render the operation of Liang to perform its purpose unsatisfactorily.

Liang teaches that ions (element 26' in Figure 1C), comprising boron or boron difluoride are ion implanted into LDS/LDD regions (elements 26S/26D in Figure 1C) with a dose from about 1×10^{13} ions/ cm^2 to about 5×10^{14} ions/ cm^2 at an energy from about 15 keV to about 50 keV. Column 3, lines 34-37.

Wolf, on the other hand, teaches a relationship between the thickness of the photoresist in order to stop 99.99% of incident ions (Boron, Phosphorous and Arsenic) at various kinetic energy levels of the implanted ion. Page 322. The Examiner presumably cites this passage to assert that in order to restrict the ionic species from being implanted into unwanted substrate regions (Examiner's motivation), 99.99% of the incident ions need to be stopped. Referring to Figure 36 on page 322 of Wolf, Wolf illustrates that the thickness of the photoresist to stop 99.99% of boron ions at an energy from about 15 keV to about 50 keV (implant energy cited by Liang) requires a thickness much greater than .2 μm . In fact, in order to stop 99.99% of boron ions at an energy of about 50 keV, the thickness of the photoresist should be at least .3 μm .

If Liang were modified to have a photoresist with a thickness between .1 μm and .2 μm , then Liang would not be able to stop 99.99% of boron ions at the implant energy levels cited in Liang. Hence, Liang would not be able to restrict the ionic species from being implanted into unwanted substrate regions as asserted by the Examiner. Thus, by modifying Liang with Wolf to have a photoresist layer with a thickness between .1 μm and .2 μm in order to restrict the ionic species from being

implanted into unwanted substrate regions, the principle of operation in Liang would change, and subsequently render the operation of Liang to perform its purpose unsatisfactorily. Therefore, the Examiner has not presented a *prima facie* case of obviousness for rejecting claims 18-20. *In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (C.C.P.A. 1959); *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984).

2. Liang and Wolf, taken singly or in combination, do not teach or suggest the following claim limitations.

Appellants respectfully assert that Liang and Wolf, taken singly or in combination, do not teach or suggest "an oxide trench; a drain region adjacent to said oxide trench; a source region adjacent to said oxide trench" as recited in claim 18. The Examiner cites elements 14A and 14B of Liang as teaching two different oxide trenches; element 24D of Liang as teaching a drain region; and element 24S of Liang as teaching a source region. Paper No. 31, page 5. Appellants respectfully traverse that Liang teaches the above-cited claim limitations.

Liang instead teaches a lightly doped drain region (element 24D as illustrated in Figure 1C) adjacent to a first shallow trench isolation (STI) structure (element 14B as illustrated in Figure 1C) and a lightly doped source region (element 24S as illustrated in Figure 1C) adjacent to a second STI structure (element 14A as illustrated in Figure 1C). Claim 18 recites an oxide trench where a drain region and a source region are adjacent to that oxide trench. The claim does not recite two separate oxide trenches. All words in a claim must be considered in judging the patentability of that claim against the prior art. *In re Wilson*, 424 F.2d 1382, 1385, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); M.P.E.P. §2143.03. Liang does not teach a source and a drain region adjacent to the same oxide trench. Therefore, the Examiner has not presented a *prima facie* case of obviousness in rejecting claim 18, since the Examiner is relying upon an incorrect, factual predicate in support of the rejection. *In re Rouffet*, 47 U.S.P.Q.2d 1453, 1455 (Fed. Cir. 1998).

Appellants further assert that Liang and Wolf, taken singly or in combination, do not teach or suggest "a photoresist layer of a thickness between .1 μm and .2 μm over said oxide trench and a substantial portion of said source and drain region, wherein a halo implant is implanted using said photoresist layer and said gate as a mask" as recited in claim 18. The Examiner cites element PR2 of Liang as teaching a photoresist layer; element 24D of Liang as teaching a drain region; element 24S of Liang as teaching a source region; and elements 14A and 14B as teaching the oxide trench. Paper No. 31, page 5. Appellants respectfully traverse.

Liang instead teaches that mask PR2 overlies all of STI structure 14A but only a portion of STI structure 14B. If the Examiner is citing STI structure 14B as teaching the oxide trench as recited in claim 18, then the mask PR2 does not cover the oxide trench as required by claim 18. Furthermore, as illustrated in Figure 1C, the mask PR2 does not cover a substantial portion of element 24S (Examiner asserts that element 24S teaches a source region). Instead, the mask PR2 covers an insubstantial portion of element 24S. Hence, Liang does not teach a photoresist layer covering a substantial portion of a source region. Neither does the mask PR2 cover a substantial portion of element 24D (Examiner asserts that element 24D teaches a drain region). Therefore, the Examiner has not presented a *prima facie* case of obviousness in rejecting claim 18, since the Examiner is relying upon an incorrect, factual predicate in support of the rejection. *In re Rouffet*, 47 U.S.P.Q.2d 1453, 1455 (Fed. Cir. 1998).

- B. Claim 19 is not properly rejected under 35 U.S.C. 103(a) as being unpatentable over Liang in view of Wolf and in further view of Thompson

The Examiner has rejected claims 19 under 35 U.S.C. §103(a) as being unpatentable over Liang in view of Wolf and in further view of Thompson. Paper No. 31, page 6. Appellants respectfully traverse for at least the reasons stated below.

1. Liang, Wolf and Thompson, taken singly or in combination, do not teach or suggest the following claim limitations.

Appellants respectfully assert that Liang, Wolf and Thompson, taken singly or in combination do not teach or suggest "wherein said halo implant is implanted at a substantially 45 degree angle" as recited in claim 19. The Examiner cites column 3, lines 18-19 of Thompson as teaching the above-cited claim limitation. Paper No. 31, page 6. Appellants respectfully traverse.

Thompson instead teaches that in prior art, halo regions (elements 15 and 16 of Figure 1) are formed by ion implantation prior to the doping of the source and drain regions by implanting a relatively heavy p-type dopant at two different angles so that the dopant lodges as illustrated in Figure 1. Column 2, lines 15-19. Thompson further teaches that instead of the halo regions of Figure 1, the region (element 25 in Figure 2) is used in accordance with the present invention in the transistor of Figure 2. Column 2, lines 45-47. Thompson further teaches that Figure 3 illustrates the fabrication of region 25 (Figure 2). Column 2, lines 62-63. Thompson further teaches that a step in the fabrication of region 25 that replaces the halo regions of Figure 1 is the implantation of a dopant (see elements 35 and 36 of Figure 3) at an angle of 30° or greater. Column 3, lines 18-19. Hence, Thompson does not teach implanting a halo implant at an angle of 30° or greater. In fact, Thompson teaches the antithesis of implanting a halo implant. Thompson specifically teaches that it does not implant a halo implant as the purpose of Thompson is to form a region to replace the halo regions as used in prior art. Therefore, the Examiner has not presented a *prima facie* case of obviousness in rejecting claim 19, since the Examiner is relying upon an incorrect, factual predicate in support of the rejection. *In re Rouffet*, 47 U.S.P.Q.2d 1453, 1455 (Fed. Cir. 1998).

2. By combining Liang with Thompson, the principle of operation of Liang would change.

If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 370 F.2d 810, 123 U.S.P.Q. 349 (C.C.P.A. 1959). Further, if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984). For the reasons discussed below, Appellants submit that by combining Liang with Thompson, the principle of operation in Liang would change and subsequently render the operation of Liang to perform its purpose unsatisfactorily.

Liang teaches that an objection of the invention is to reduce drain breakdown voltage to increase substrate current without degrading punchthrough effect. Column 1, lines 50-52. Liang further teaches that a key feature of the invention is a counter doped halo region for the source region with drain halo regions in an ESD transistor. Column 1, lines 55-57. Liang further teaches that in step 44, as illustrated in Figure 1C, a mask PR2 is formed with windows W2L and W2R. Column 3, lines 21-22. Liang further teaches that the window W2L is used to form halo implants of a p-type dopant into a p-well on either side of the gate electrode stack below the lightly doped source and drain regions. Column 3, lines 28-31.

Thompson, on the other hand, teaches that in prior art, halo regions (elements 15 and 16 of Figure 1) are formed by ion implantation prior to the doping of the source and drain regions by implanting a relatively heavy p-type dopant at two different angles so that the dopant lodges as illustrated in Figure 1. Column 2, lines 15-19. Thompson further teaches that instead of the halo regions of Figure 1, the region (element 25 in Figure 2) is used in accordance with the present invention in the transistor of Figure 2. Column 2, lines 45-47. Thompson further teaches that Figure

3 illustrates the fabrication of region 25 (Figure 2). Column 2, lines 62-63. Thompson further teaches that a step in the fabrication of region 25 that replaces the halo regions of Figure 1 is the implantation of a dopant (see elements 35 and 36 of Figure 3) at an angle of 30° or greater. Column 3, lines 18-19. Hence, Thompson teaches away from implanting halo regions.

By combining Liang with Thompson, the principle of operation of Liang would change, and subsequently render the operation of Liang to perform its purpose unsatisfactorily. As stated above, Thompson teaches forming a region (element 25 in Figure 2) to replace halo implants. By combining Liang with Thompson, Liang would no longer be able to form halo implants of a p-type dopant into a p-well on either side of the gate electrode stack below the lightly doped source and drain regions. By not being able to form halo implants, Liang would not be able to provide a counter doped halo region for the source region with drain halo regions in an ESD transistor thereby not being able to reduce drain breakdown voltage to increase substrate current, which is an object of the invention. Thus, by combining Liang with Thompson, the principle of operation in Liang would change, and subsequently render the operation of Liang to perform its purpose unsatisfactorily. Therefore, the Examiner has not presented a *prima facie* case of obviousness for rejecting claims 19. *In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (C.C.P.A. 1959); *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984).

3. The Examiner's motivation is insufficient to support a *prima facie* case of obviousness in rejecting claim 19.

A *prima facie* showing of obviousness requires the Examiner to establish, *inter alia*, that the prior art references teach or suggest, either alone or in combination, all of the limitations of the claimed invention, and the Examiner must provide a motivation or suggestion to combine or modify the prior art reference to make the claimed inventions. M.P.E.P. § 2142. The showings must be clear and particular and supported by objective evidence. *In re Lee*, 277 F.3d 1338, 1343,

61 U.S.P.Q.2d 1430, 1433-34 (Fed. Cir. 2002); *In re Kotzab*, 217 F.3d 1365, 1370, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000); *In re Dembiczak*, 50 U.S.P.Q.2d. 1614, 1617 (Fed. Cir. 1999). Broad conclusory statements regarding the teaching of multiple references, standing alone, are not evidence. *Id.*

The Examiner's motivation for modifying Liang with Thompson to implant a halo implant at a substantially 45 degree angle, as recited in claim 19, is "to improve punchthrough characteristics (col. 1, lines 40-41)." Paper No. 31, page 7. This motivation is insufficient to support a *prima facie* case of obviousness as discussed below.

The Examiner's motivation does not address as to why one of ordinary skill in the art would modify Liang to implant a halo implant at a substantially 45 degree angle. The Examiner's motivation (Examiner cited column 1, lines 40-41 of Thompson) does not relate to implanting a halo implant. Instead, the Examiner's motivation is directed to implanting an ion in a region to replace halo regions. As stated above, Thompson teaches that in prior art, halo regions (elements 15 and 16 of Figure 1) are formed by ion implantation prior to the doping of the source and drain regions by implanting a relatively heavy p-type dopant at two different angles so that the dopant lodges as illustrated in Figure 1. Column 2, lines 15-19. Thompson further teaches that instead of the halo regions of Figure 1, the region (element 25 in Figure 2) is used in accordance with the present invention in the transistor of Figure 2. Column 2, lines 45-47. Thompson further teaches that Figure 3 illustrates the fabrication of region 25 (Figure 2). Column 2, lines 62-63. Thompson further teaches that a step in the fabrication of region 25 that replaces the halo regions of Figure 1 is the implantation of a dopant (see elements 35 and 36 of Figure 3) at an angle of 30° or greater. Column 3, lines 18-19. Thompson further teaches that the devices of the present invention will have a higher concentration of the dopant and consequently improved punchthrough characteristics. Column 1, lines 40-41. Thompson further teaches that this is achieved by ion implanting at approximately

30° or greater prior to the formation of the source and drain regions. Column 1, lines 42-44. Thus, Thompson teaches that punchthrough characteristics are improved by replacing halo regions with a region where the fabrication of that region includes the step of implanting an ion at approximately 30° or greater. Hence, this motivation is not directed to implanting a halo implant. A *prima facie* case of obviousness requires the Examiner to provide some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art to modify Liang to implant a halo implant at a substantially 45 degree angle. M.P.E.P. §2143. As the Examiner has not presented such motivation, the Examiner has not presented a *prima facie* case of obviousness in rejecting claim 19. M.P.E.P. §2143.

- C. Claim 20 is not properly rejected under 35 U.S.C. §103(a) as being unpatentable over Liang in view of Wolf and in further view of Thackeray.

The Examiner has rejected claim 20 under 35 U.S.C. §103(a) as being unpatentable over Liang in view of Wolf and in further view of Thackeray. Paper No. 31, page 7. Appellants respectfully traverse these rejections for at least the reasons stated below.

As stated above, a *prima facie* showing of obviousness requires the Examiner to establish, *inter alia*, that the prior art references teach or suggest, either alone or in combination, all of the limitations of the claimed invention, and the Examiner must provide a motivation or suggestion to combine or modify the prior art reference to make the claimed inventions. M.P.E.P. § 2142. The showings must be clear and particular and supported by objective evidence. *In re Lee*, 277 F.3d 1338, 1343, 61 U.S.P.Q.2d 1430, 1433-34 (Fed. Cir. 2002); *In re Kotzab*, 217 F.3d 1365, 1370, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000); *In re Dembiczak*, 50 U.S.P.Q.2d. 1614, 1617 (Fed. Cir. 1999). Broad conclusory statements regarding the teaching of multiple references, standing alone, are not evidence. *Id.*

The Examiner's motivation for modifying Liang with Thackeray to have a photoresist layer that comprises a deep ultraviolet layer, as recited in claim 20, is "to effectively activate the photoactive component of the photoresist system (see col. 12, lines 60-62 and col. 13, lines 1-6)." Paper No. 31, page 7. This motivation is insufficient to support a *prima facie* case of obviousness as discussed below.

The Examiner's motivation is not evidence as to why one of ordinary skill in the art, with the reference Liang in front of him, would have been motivated to modify Liang with the teachings of Thackeray. The Examiner's motivation is instead a motivation for Thackeray to solve its problem as discussed below.

Thackeray teaches that linewidth variation is unacceptable for most commercial applications. Column 3, lines 24-25. Thackeray further teaches that it would be desirable to have chemically amplified photoresist compositions capable of providing high resolved fine line images, including images of submicron and sub half-micron dimension, which are PEB insensitive. Column 3, lines 25-29. Thackeray further teaches that it would be desirable to having such a chemically amplified photoresist where variation in linewidth as a function of post exposure bake temperature is reduce or eliminated. Column 3, lines 29-32. Thackeray further teaches that following coating of the photoresist onto a surface, it is dried by heating to remove the solvent until preferably the photoresist coating is tack free. Column 12, lines 57-59. Thackeray further teaches that it is imaged through a mask in a conventional manner. Column 12, lines 59-60. Thackeray further teaches that the exposure is sufficient to effectively activate the photoactive component of the photoresist system, i.e., generate sufficient acid to produce a patterned image in the resist coating layer following post exposure bake. Column 12, lines 60-64. Thackeray further teaches that the photoresists of the invention comprise a photoacid generator that liberates a halogenated sulfonic acid upon photolysis. Column 4, lines 6-8. Thackeray further teaches that it has been found that PEB sensitivity as a consequence of a high temperature bake is substantially reduced when using the

halogenated sulfonic acid generator. Column 3, lines 41-44. Hence, Thackeray teaches that linewidth variation across a wafer may be reduced (problem to be solved in Thackeray) by effectively activating the photoactive component of the photoresist system (Examiner's motivation), i.e., generate sufficient acid to produce a patterned image in the resist coating layer following post exposure bake. Thus, the Examiner's motivation is directed to solving the problem presented in Thackeray.

The Examiner, however, must provide objective evidence as to why one of ordinary skill in the art would modify Liang with Thackeray to have a photoresist layer that comprises a deep ultraviolet layer. *In re Lee*, 61 U.S.P.Q.2d 1430, 1433-1434 (Fed. Cir. 2002); *In re Kotzab*, 55 U.S.P.Q.2d 1313, 1318 (Fed. Cir. 2000). Merely stating motivation for Thackeray to solve its problem is not evidence for modifying Liang with Thackeray to have a photoresist layer that comprises a deep ultraviolet layer. *In re Lee*, 61 U.S.P.Q.2d 1430, 1434 (Fed. Cir. 2002). Consequently, the Examiner's motivation is insufficient to support a *prima facie* case of obviousness for rejecting claim 20. *Id.*

IV. CONCLUSION

For at least the reasons stated above and in the Appeal Brief filed by Appellants on August 9, 2004, the rejections of claims 1, 4, 5, 7, 8, 11, 12, 14 and 18-20 are in error. Appellants respectfully request reversal of the rejections and allowance of claims 1, 4-8, 11, 12 and 14-20.

Respectfully submitted,

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